STUDIES ON THE FAUNA OF TRICHOPTERA (INSECTA) OF KOREA. I. SUPERFAMILY RHYACOPHILOIDEA

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Entomological investigations in the northern part of the Korean Peninsula have remarkably increased during the last 2-3 decades after a series of expeditions organized by Polish, Hungarian and Bulgarian zoologists to the Korean P. D. R. As to the caddisflies, 31 species were listed for the region before that period (C h u, 1969). This list, however, is neither exhaustive nor critically compiled. On the one hand, it is based entirely on old determinations, some of then evidently incorrect (e. g. *Glossosoma bolloni* C u r t., *Goera pilosa* F a b r.), and the most important pre-war publication on Korean Trichoptera, with data on 15 species (T s u d a, 1942) has evidently been overlooked.

First modern and the most important contribution to that matter is the one of B o t o s a n e a n u (1970), where 61 species are included, 20 of them described as new. The brief review of the literature on N. Korea caddisflies ends with the description of three species (O l a h, 1985), and the paper of M e y (1989). Thus, the North Korean list of Trichoptera now includes about 80 species. This figure is rather low and could well illustrate the insufficient level of knowledge on these insects for the region.

Since 1974, Bulgarian entomologists have been collecting material in the Korean P. D. R. on six occasions. These collections (with abbreviation of collectors' names used further on in this text) are: Dr. M. Josifov (MJ) — July-August 1974, May-June 1975, and August 1977; P. Beron and A. Popov (B&P) — August 1982; Dr. M. Josifov, P. Beron and Z. Hubenov (J, B&H) — May-June 1987; K. Kumanski and A. Popov (KK) — September-October 1978. Trichoptera are extremely variously represented in these collections: single specimens from a few localities (MJ), numerous samples from few localities (J, B&H), and many localities with usually large samples (KK). The material is preserved, if not otherwise stated, in the National Natural History Museum, Sofia (in alcohol). It was the basis for our investigations. In addition, three small other collections were loaned and also included in the study: Drs. S. Mahunka and H. Steinmann (M&S) — May-June 1970, and Drs. J. Papp and S. Horvatovich (P&H) — August 1971, from the Natural History Museum in Budapest, and Drs. R. Bielawski and M. Mroczkowski (B&M) — September 1970 from the Institute of Zoology at the Academy of Sciences in Poland. Altogether about 8000 adults have been determined and more than 130 species from 20 families established. The results are intended to be published periodically in a series of papers, the present being the initial one.

Besides the colleagues who collected a considerable part of the material, thanks are also due to the following foreign colleagues: Dr. L. Botosaneanu (Zoological Museum, Amsterdam) who helped in obtaining of M&S, P&H and B&M collections and provided various information needed; Dr. W. Mey (Humboldt University, Berlin), for his valuable consultation and comments on the new taxa; Prof. Tian Li-Xin (Nanjing Agricultural University, China), for

his information and literature on the Chinese caddisflies. Among the colleagues who greatly assisted me in providing necessary literature I am especially indebted to Dr. T. Ito (Hokkaido Fish Hatchery, Japan), to Dr. K. Tanida (Osaka University, Japan), to Prof. I. Levanidova (Institute of Pedology, Vladivostok, the USSR), and to Prof. J. Morse (Clemson University, S. C., USA).

Generalized list of the localities

Province Hwanghe namdo (Southern Hwanghe)

1a: Hedžu, 6. VI. 1987 (J, B&H, at light).
1b: same place, 3. VI. 1975 (MJ).
1c: same place, 26-27. IX. 1978 (KK, at light).
2a: Sujang Mt. (a small mountain near Hedzu), below and above the watrefall (ca. 300-500 m a. s. l.). Rhithral, with hygropetric niches, 28. VIII. 1982 (B&P).
2b: same place, 26-27. IX. 1978 (KK).
3 : Streamlet near Sinvon dam, Muhak vill., 26. IX. 1978 (KK).

Province Kesong-si

4 : Bagjŏn Mt. (ca. 20 km N of Kesong), mountain river below the waterfall of Bagjŏn (=Bagjŏn-popo), 21. V. 1975 (MJ).
5 : same mountain, waterfall of Bagjŏn (27 km N of Kesong), 7. VI. 1970 (M&S).
6 : San-chŏn vill. (=San-chŏn-ri), 22 km SE of Kesong, 7. VI. 1970 (M&S).
7 : San-chŏn valley (=San-chŏn-tong), 20 km SE of Kesong, 7. VI. 1970 (M&S).
8a: Kesong, inner sity, 7. VI. 1970 (M&S).
8b: same place, 25. VIII. 1982 (B&P).

Province Kangvŏn

9a: Kumgang Mts., the foothills near the hotel Go-song and Ondžŏng vill. (ca. 50 m a. s. l.). Stony stream, hyporhithral-epipotamal zone, 2-3. X. 1978 (KK, mostly at light).
9b: same place, 29-31. V. 1970 (M&S).
9c: same place, 18-20. VIII. 1982 (B&P, at light).
9d: same region, Man-mul-san (ca. 700 m a. s. l.), 30. V. 1970 (M&S).
9e: same region, 26. V. 1975 (MJ).
9f: same region, 100-900 m a. s. l., 4. VI. 1987 (J, B&H).
9g: same region, 700 m a. s. l., 30. VII. 1974 (MJ).
10 : Stream and small torrents of the plain near Časan vill., 1-3 km from the sea (ca. 25 km E of Vŏnsan), 6. X. 1978 (KK).
11 : River Čončhon, near Samthe vill. (ca. 8 km W of Vŏnsan). Epipotamal zone, 6. X. 1978 (KK).
12 : same region, streamlet Samthe above Samthe vill. (left tributary of Čončhon river). Rhithral zone, 6. X. 1978 (KK).
13 : Vŏnsan, 4. X. 1978 (KK, at light).
14 : Dam Tongčong (35 km S of Vŏnsan), 18. IX. 1970 (B&M).
15 : Si-Zung-ho, woods on coastal dunes, 28. V. 1970 (M&S).
16a: Lake Sam-ilp-ho (district Koson), 25. V. 1975 (MJ).
16b: same lake, 29. V. -VI. 1970 (M&S).

Province Phyŏngyang-si

17a: Phyŏngyang sity, park Moran, artificial torrent, 28. IX. 1978 (KK).
17b: same place, 17. VIII. 1982 (B&P).
18a: Phyŏngyang sity, river Tedong, 28. IX. -7. X. 1978 (KK, at light).
18b: same place, 17-29. V. 1975 (MJ. at light).
18c: same place, 3. VIII. 1977 (MJ, at light).
18d: same place, 12. VIII. 1974 (MJ, at light).
18e: same place, 9. VI. 1987 (J, B&H, at light).
18f: same place, 5-17. VIII. 1971 (P&H).
18h: same place, 6-15. VIII. 1982 (B&P, at light).
19a: Phyŏngyang, park Tesong, 5. VIII. 1977 (MJ).
19b: same place, 5-23. VII. 1974 (MJ).
19c: same place, 21. V. 1970 (M&S).
19d: same place, 22. IX. 1978 (KK).

20a: Bong-ha vill., banks of river Tedong, 23. V. 1970 (M&S).
20b: same place, 16-17. VIII. 1971 (P&H).
21 : Slow tributary of dam Sŏgam, near Sunan vill., 10. X. 1978 (KK).

Province Phyŏngan namdo (Southern Phyŏngan)

22 : Dam Tesŏng, very small current, 23. IX. 1978 (KK).
23 : Stream near Kočhang vill. (ca. 20 km SW of Phyŏngyang), 24. IX. 1978 (KK).
24 : The outflow of dam Jongphung (left tributary of river Čhongčhong), ca. 200 m alt., 29. IX. 1978 (KK).
25 : Sŏgam, 17. V. 1975 (MJ).
26 : Rjŏngak-san, 30. V. 1975 (MJ).
27 : Thesong, bei Kijang, 31. V. 1975 (MJ).
28 : River Tedong, Nun-Ra-do (an island of Tedong), 14. VIII. 1971 (P&H).

Province Phyŏngan pukdo (Northern Phyŏngan)

29a: Myohyang Mts., the foothills (ca. 200 m a. s. l.), the hotel, 22. V. 1987 (J. B&H, at light).
29b: same place, 8-12. VI. 1987 (J. B&H, at light).
29c: same place, 14-18. VIII. 1982 (B&P, at light).
30 : Myohyang Mts., on the road to Sangvon-am, ca. 400 m a. s. l. (carried by Asilidae), 13. VIII. 1982 (B&P).

Province Rjangang

31 : Samdžijon, 16. VII. 1974 (MJ).
32 : Chann-Pay plateau, Sam-Zi-yan, 1600 m a. s. l., 25-28. VIII. 1971 (P&H).
33 : Sam-Zi-yan, the hotel, 25. VIII. 1971 (P&H).
34 : same region, Kilshu, 22. VIII. 1971 (P&H).
35 : Mt. Pektusan, 1900 m alt., 18. VIII. 1971 (P&H, sample No. 216).

Province Hamgyŏng namdo (Southern Hamgyŏng)

36 : Mačŏn, 20 km NE of Hamhyng, 26. IX. 1970 (B&M).

Province Hamgyŏng pukdo (Northern Hamgyŏng)

37 : Onpho vill. (near Kjŏngsŏng), 10-12. VI. 1975 (MJ).
38 : Onpho vill. (distr. Džyur), 6. IX. 1970 (B&M).

SYSTEMATICAL PART

Family RHYACOPHILIDAE

The investigated collections include altogether 218 representatives of the family. All insects belong to the basic genus *Rhyacophila*. Eleven species have been reported from Korea by Botosaneanu (1970).

Rhyacophila coreana Tsuda, 1940

This species has been described from North Korea and found there again (in the provinces Hamhyng-si and Kangŏng) by Botosaneanu (1970) and, respectively, Olah (1985); just recently Ko & Park (1988) have reported it in the South Korean part of the province Kangvŏn.

Material studied: Loc. 4 — 1 ♂; Loc. 17 — 1 ♂, 1 ♀; Loc. 12 — 2 ♀.

Only the male of this species was known so far. Although somewhat provisionally associated, the probable female is figured here (Figs. 1-4).

Distribution: Korea, the Far East of the USSR — the basins of the rivers Ussuri and Amur (Левanидова, 1982).

Rhyacophila mroczkowskii Botosaneanu, 1970

Material studied: Loc. 2b — 1♂, 1♀: Loc. 9b — 1♀; Loc. 29 c (probably one of the type localities) — 1♂.

Distribution: Korea, the southernmost region of the Soviet Far East (Левановидова, 1982).

Rhyacophila narvae Navas, 1926

Material studied: Loc. 4 — 1 ♂, Loc. 29b — 1 ♂.

Distribution: This is perhaps the only caddisfly from the genus to occur both in the easternmost territories of the Palaearctic and in the west of North America. Usually the amphipacific type of distribution is demonstrated at a higher taxonomical level.

Rhyacophila cf. *tonneri* Mey, 1989

Material studied: Loc. 9b — 1 ♀; Loc. 37 — 1 ♀.

The processus spermathecae of our insects corresponds well to that figured (Botosaneanu, 1970) for the female of *Rh. narvae*. This author, however, is not categorical in its association with males. On the other hand, Schmid (1981) presents a rather different processus spermathecae of *Rh. narvae* (after specimen from Oregon, the USA). The recent discovery of *Rh. tonneri* — a close relative of *Rh. narvae* — could maybe offer an explanation of this contradiction. I enclose here (Figs. 5—9) several genital drawings which correspond better to the female of *tonneri* than the female of *narvae* (in Schmid 's version).

Distribution: North Korea.

Rhyacophila riedeliana Botosaneanu, 1970

The species was known only after the holotype male (province Hamhyngsi).

Material studied: Loc. 9b — 2♂, 2 ♀; Loc. 29 b — 1 ♂.

Habitually the females greatly resemble the males, so I give some drawings of the probable female of this species (Figs. 10-13).

Distribution: North Korea.

Rhyacophila lata Martynov, 1918

Material studied: Loc. 5—1♀; Loc. 6 — 2♂; Loc. 7 — 9♂; Loc. 9a — 11♂, 3♀; Loc. 9b — 1♀; Loc 10 — 6♂; Loc. 11 — 1♀; Loc. 12 —3♂, 1♀; Loc. 14 — 1♀; Loc. 2b — 2♂; Loc. 24 — 81♂, 12♀; Loc. 29a — 1♀; Loc. 29b — 7♂, 11♀; Loc. 29c — 1♂; Loc. 35 — 1♂; Loc. 38 — 2♂.

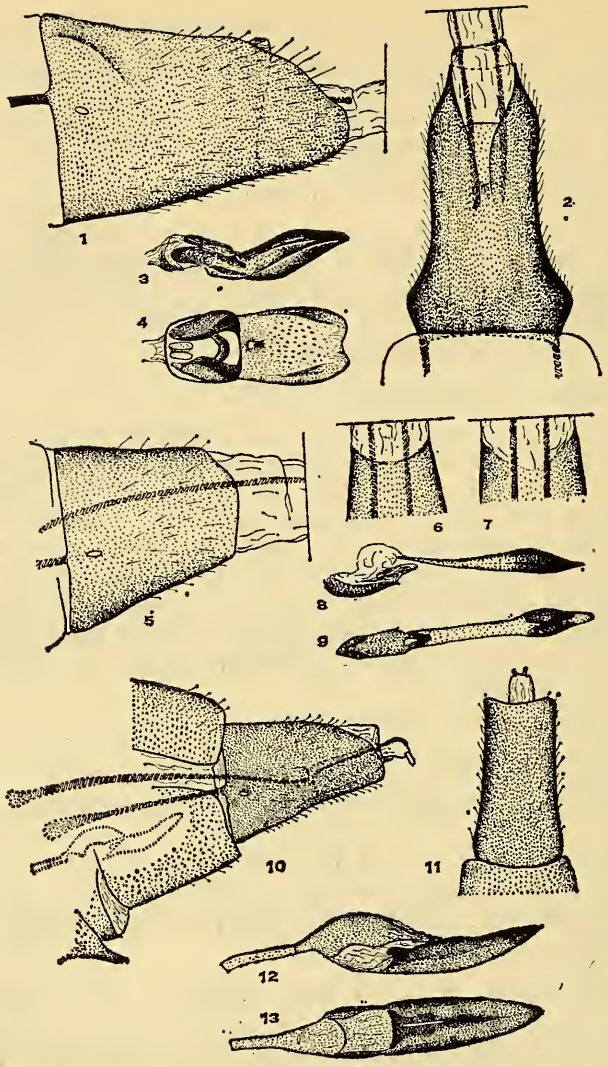
Two localities in Korea were known so far (Botosaneanu, 1970), but the above-cited abundance both of localities and samples leads to the conclusion that *Rh. lata* seems to be the most common representative of the genus in this country.

Distribution: Eeastern Palaearctic.

Rhyacophila vicina Botosaneanu, 1970

Material studied: Loc. 5 — 1 ♂; Loc. 9b — 1 ♀; Loc. 9d — 4 ♂; Loc. 9e — 2 ♂, 3 ♀; Loc. 9f — 1 ♀.

Distribution: Korea, southern part of the Soviet Far East and the Kurile Islands (Левановидова, 1982).



Figs. 1-13. Female genitalia of *Rhyacophila coreana* T s., *Rhyacophila* cf. *tonneri* M e y, and *Rhyacophila riedeliana* B o t s.
Rh. coreana: 1 — Segment VIII, lateral; 2 — the same, dorsal; 3 — Processus spermathecae, lateral; 4 — the same, ventral. *Rh.* cf. *tonneri:* 5 — Segment VIII, lateral; 6 — the same (distal portion), ventral; 7 — the same, dorsal; 8 — Processus spermathecae, lateral; 9 — the same, ventral. *Rh. riedeliana:* 10 — end of the abdomen, lateral; 11 — the same, ventral; 12 — Processus spermathecae, lateral; 13 — the same, ventral

Rhyacophila angulata M a r t y n o v, 1910

M a t e r i a l s t u d i e d: Loc. 9a — 1 ♀; Loc. 11 — 16 ♂, 2 ♀; Loc. 12 — 1 ♀; Loc. 29a — 5 ♂ (this is apparently the loc. No 17 of B o t o s a n e a n u, 1970).

D i s t r i b u t i o n: A species widespread in the SE part of the Palaearctic region.

Rhyacophila retracta Martynov, 1914

Material studied: Loc. 9e — 1 ♂, 1 ♀; Loc. 12 — 1 ♂, 1 ♀.

Distribution: Another species relatively widespread in the SE Palaearctic.

Rhyacophila kumgangsanica sp. n.

Small insect, forewing length male, 6 mm. Palpi and legs smoky yellowish; head, thorax and wings uniformely brownish. F_1 in forewing very long, F_2 still longer, F_3 half as long as F_2, F_4 and F_5 very short.

Male genitalia. Sternite VII with short distomedial dent. Segment IX a short, well sclerotized ring with its tergal part larger than sternal. Segment X in lateral view vertical, C-shaped, its dorsal part enlarged and, viewed dorsally, faintly trilobed (Fig. 15); ventral portion of this segment forming three lobes produced caudad, the lowest (and longest) corresponding to the anal sclerites (after Schmid, 1970). Apical band well developed, U-shaped; tergal band, connecting phallotheca and apical band, also well visible. Phallic apparatus drawn deeply into segment IX. Phallotheca in form of a narrow, oblique ring, and a semimembranous ventral portion; the latter supporting the ventral lobe of aedeagus from beneath. Ventral lobe of aedeagus a heavily sclerotized, horisontal tongue, twice longer than the ventral portion of phallotheca. The proper aedeagus a fine, tapering tube, arising above the base of the ventral lobe and nearly three times shorter than latter (Fig. 14). Parameres entirely absent. A very distinctive, strongly chitinised, long process attached to the middle of segment X; in fact, this is the most typical feature of the species. Viewed frontally, this process is deeply bifurcate along its upper halflength, and also divided ventrally, where a pair of short and knob-like projections appear (Fig. 16). Although faintly chitinized, the connection between segment X and its medial process does not allow their free articulation. Inferior appendages simple shaped, generally elongate; coxopodite twice longer than harpago, with its dorsal side somewhat twisted. Harpago with rounded caudal margin and short area of black, dense spines (Fig. 20).

Female unknown.

Material studied: Loc. 9a — holotype male.

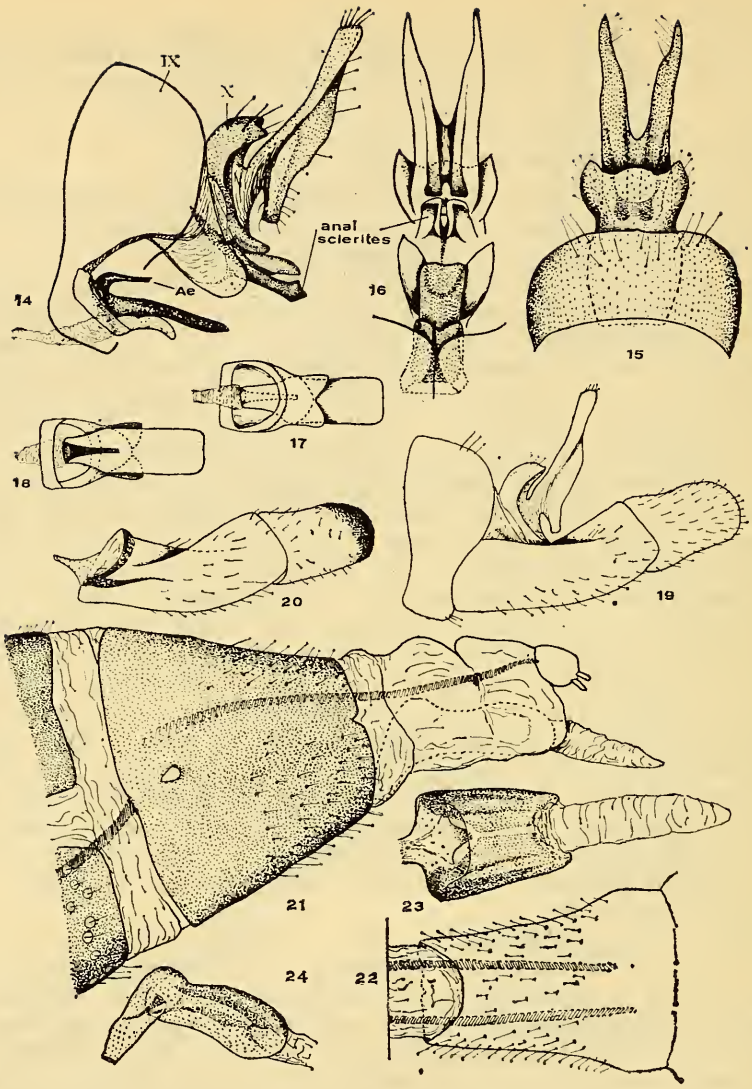
Derivatio nominis: Kumgang-san (=Kumgang Mts.).

Discussion: It is difficult to establish the proper position of *Rh. kumgangsanica* sp. n. within the genus, especially deeper in the branch level of *philopotamoides* (after the system proposed by Schmid (1970)). On the one hand, some genital features (e. g. absence of dorsoapical lobe and shortened ventral portion of segment IX; ventral lobe of aedeagus forming a big plate) correspond to the general characteristics of the Subbranch (="rameau" in Schmid, op. cit.) of *castanea*. On the other hand, following some other features (e.g. unmodified, simple shape of harpagones; shortened endotheca; absence of parameres) it should be placed somewhere in the Subbranch of *invaria*. Finally, the presence of a third complex of features (phallic apparatus deeply drawn into segment IX; size and form of aedeagus with dorsal appendages lacking; presence of a big, modified process arising from the middle of segment X and suggesting the idea of a peculiar derivate of segment XI) comes as if to confirm the above mentioned complication.

Rhyacophila sp.

Material studied: Loc. 29a — 2 ♀.

These insects do not belong to any of the species known in Korea so far (and, most probably, neither to the species with unknown females; all corres-



Figs. 14-24. Genitalia of *Rhyacophila kumgangsanica* sp. n., and *Rhyacophila* sp. *Rhyacophila kumgangsanica*, ♂ : 14—IX and X segment (inferior appendages omitted), lateral; 15 — the same, dorsal; 16 — X segment and phallic apparatus, caudal; 17 — phallic apparatus, ventral; 18 — the same, dorsal; 19 — general view of genitalia (less magnified), lateral; 20 — internal view of the right inferior appendage (less magnified). *Rhyacophila* sp., ♀ : 21 — general view, lateral; 22 — Segment VIII, ventral; 23 — Processus spermathecae, ventral; 24 — the same, lateral

ponding males are small-sized). Thus, one of the most distinctive features here are the big dimensions: length of forewing, 15,5-16,0 mm (i. e. a wingspan of 33-34 mm!). A brief description which could enable the final determination of this species in the future follows.

Forewing brownish, densely spotted; the spots light, usually faint and somewhat better developed only on the anal third of the membrane. Hindwing

smoky hyaline. Genitalia simple, with the last segments forming a short, membranous oviscapt (Fig. 21). Processus spermathecae also shortened, stout (Figs. 23-24).

This big-sized species is new to Korea (or, to the science as well?), but since not associated with male, it should rather be left unspecified.

Family HYDROBIOSIDAE

Apsilohorema coreanum Botosaneanu, 1970

Material studied: Loc. 9a — 2 ♀.

This is the only representative of the family in Korea and the first find of the species after its description. The locality is probably the same as the typical one. Male of this species remains still unknown.

Distribution: A probable Korean endemic.

Family GLOSSOSOMATIDAE

This family is represented in small number of taxa in the collection; only four species have been established. On the contrary, the number of specimens is very high and comprises about 25% of the total. One species — *Synagapetus sibiricus* (Mart.) — with several abundant light trapping samples definitely prevails in the total figure of 1915 representatives of the family.

Synafophora altaicum (Martynov, 1914)

Known in Korea only from the Myohyang Mts. (Botosaneanu, 1970).

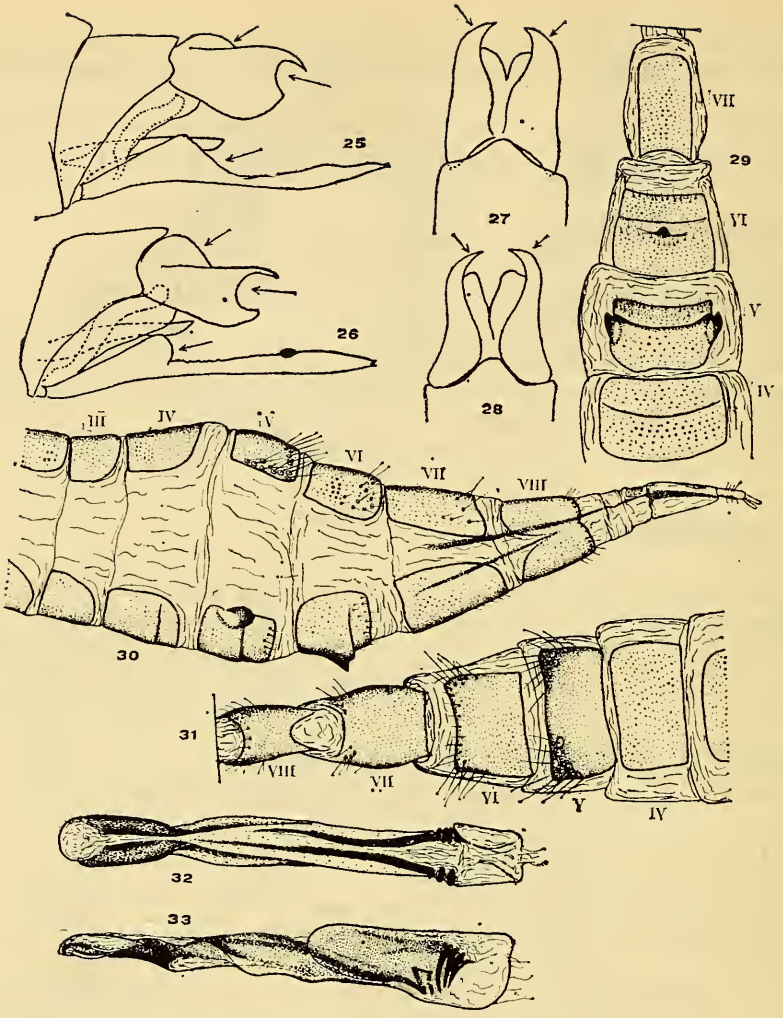
Material studied: Loc. 9a — 10 ♂, 3 ♀; Loc. 29a — 1 ♂, 71 ♀; Loc. 29b — 27 ♂, 92 ♀; Loc. 29c — 3 ♂, 9 ♀.

This species is described only after a pair of insects, the female remaining practically unknown. Our abundant material allows some additions to the description.

Male genitalia: Some of the structures are distinctively variable in shape; this is best demonstrated in the gonopodes (Figs. 27 and 28 show the extreme cases). In segment X, the shape of the laterocaudal excision and the shape of the "claws" also variable (Figs. 25 and 26). Several less remarkable variations could be observed also in the shape of the lower lobes of segment X, and in the development degree of development of the teeth of sternites VI and VII.

Female genitalia: Fourth abdominal tergite without setae. Fifth tergite with numerous long setae along the lateral and caudal borders. Tergites VI and VII also with numerous (but somewhat shorter) setae in their laterocaudal zones (Fig. 31). Sternite IV with a transversal line; sternite V with a similar line and a pair of well individualized, lateral bulges (gland terminals?); sternite VI with a ventromedial "tooth" (Fig. 30). Sclerites of segment VIII chitinised not better than the previous ones, partly fused (Fig. 30). Two last abdominal segments forming a telescope ovipositor, segment IX with a faint tergal sclerite and two dark, sword-like internal rods. Processus spermathecae, Figs. 32-33.

Distribution: Widespread in the Eastern part of the Palaearctic.



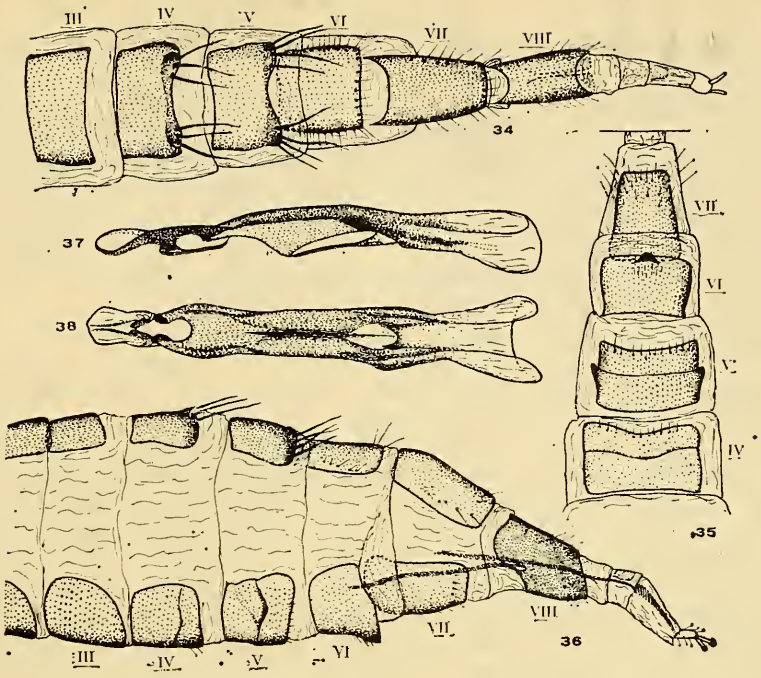
Figs. 25-33. Genitalia of *Synafophora altaicum* (M a r t).)
M a l e: 25 and 26 — variability in the genital structures, lateral; 27 and 28 — the same, dorsal. F e m a l e: 29 — IV-VII abdominal segments, ventral; 30 — abdomen, lateral; 31 — IV-VIII abdominal segments, dorsal; 32 — Processus spermathecae, ventral; 33 — the same, lateral

Synafophora ussuricum (M a r t y n o v, 1934)

M a t e r i a l s t u d i e d: Loc. 9a — 1 ♂, 13 ♀; Loc. 9f — 2 ♀; Loc. 11 — 1 ♀; Loc. 12 — 8 ♂, 12 ♀; Loc. 29a — 1 ♂, 5 ♀; Loc. 29b — 7 ♀; Loc. 29c — 1 ♂, 30 ♀.

As in the previous species, female genitalia of *S. ussuricum* have not been described and determination was possible only after males. The following description is an attempt to fill up this gap.

F e m a l e g e n i t a l i a: Both tergites IV and V with a few setae, grouped in the distal corners, which appear somewhat elevated. Each corner of tergite IV usually bears 3 (exceptionally 2 or 4) strong setae, of tergite V — 4 (rarely 3) setae (Figs. 34, 36). Tergites VI and VII, as in *S. altaicum*,



Figs. 34-38. Female genitalia of *Synafophora ussuricum* (M a r t.)
34 — abdomen ventral; 35 — IV-VII abdominal segments, ventral; 36 — abdomen, lateral; 37 — Processus spermathecae, lateral; 38 — the same, ventral

with numerous setae along their hind and lateral borders. Sternite IV with transversal chitinous line; lateral bulges of sternite V less individualized than those in *S. altaicum*. Segment VIII distinct: better sclerotized and somewhat darker than previous sclerites, with its tergal part longer than sternal, both parts fused, the sternal one with a narrow longitudinal membranous strip. Processus spermathecae, Figs. 37-38.

D i s t r i b u t i o n: Eastern palaearctic species, similar to *S. altaicum*.

Synagapetus sibiricus (M a r t y n o v, 1918)

M a t e r i a l s t u d i e d: Loc. 9a — 8♂, 20♀; Loc. 9c— 1♂, 9♀; Loc.11 — 18♂, 9♀; Loc. 12 — 63♂, 49♀; Loc. 24 — 25♂, 14♀; Loc. 18a — 1♀; Loc. 29a — 415♂, 755♀; Loc. 29b — 53♂, 150♀; Loc. 29c — 3♂, 5♀.

From the numerous localities (together with the three in B o t o s a n e a n u (1970), one of which is in the northernmost province Hamgyŏng pukdo) it becomes evident that the species is widespread throughout the country. It is also with broad ecological valency within the rhithral and the potamal.

D i s t r i b u t i o n: East Palearctic.

Synagapetus jacutorum M a r t y n o v, 1934

M a t e r i a l s t u d i e d: Loc. 2 b — 1 ♂.

This species is new for the Korean entomofauna.

D i s t r i b u t i o n: Similar to the previous species, but much more rare.

Family HYDROPTILIDAE

As in the other regions where samplings have been done by specialists other than trichopterologists, this family is the most insufficiently studied group of caddisflies in Korea. Botosaneanu (1970) first reported three species (two of which newly described). Altogether 212 specimens belonging to 3 genera and 12 species respectively have been determined, Seven of the species are described as new, and two other (represented by females only) are left unnamed, although possibly new, too. No doubt, of course, there are a lot of hydroptilids to be expected in this country so rich in running waters, such as, for instance, genus *Agraylea*, found recently in the Soviet Far East (Botosaneanu & Levanidova, 1988).

Stactobia sujangsanica sp. n.

Forewing length male, 1,8-2,0 mm, female, 2,0-2,2 mm. Antennae 18-segmented (♂, ♀). Male forecoxae fringed.

Male genitalia: Sternite VII with the usual, long sinusoidal median appendage. Anterolateral apodemes of tergite IX longer than the tergite itself; its lateroapical corners obtuse, with a faintly marked, angulate subterminal apophyse (Figs. 39, 42). Inferior appendages distally well chitinised, each produced into two caudal lobes — one bigger, dorsolateral, and a smaller, ventromedial, projected caudally as much as the superior appendages. Superior appendages are the most intensively chitinized elements in the genitalia, and have the form of strong, black hooks pointed medialy and downwards (Figs. 41, 42). Tergal part of segment X membranous, without chitinous plates and with two lateral groups of sparse, rudiment setae. Aedeagus a simple membranous tube with equal basal and distal portions. A distinct, twisted in strong spiral, inner spine at the end of the basal portion; another spine attached externally to the left subapical side of the distal tube (Fig. 44).

Female genitalia: Segment VIII with chitinized and densely haired sclerites. Terminal segments of abdomen forming a long, simple ovipositor. A fissure-like furrow on the ventrobasal side, just behind caudal margin of segment VIII (Fig. 45). Processus spermathecae a modified, relatively big, elongate structure (Figs. 46, 47).

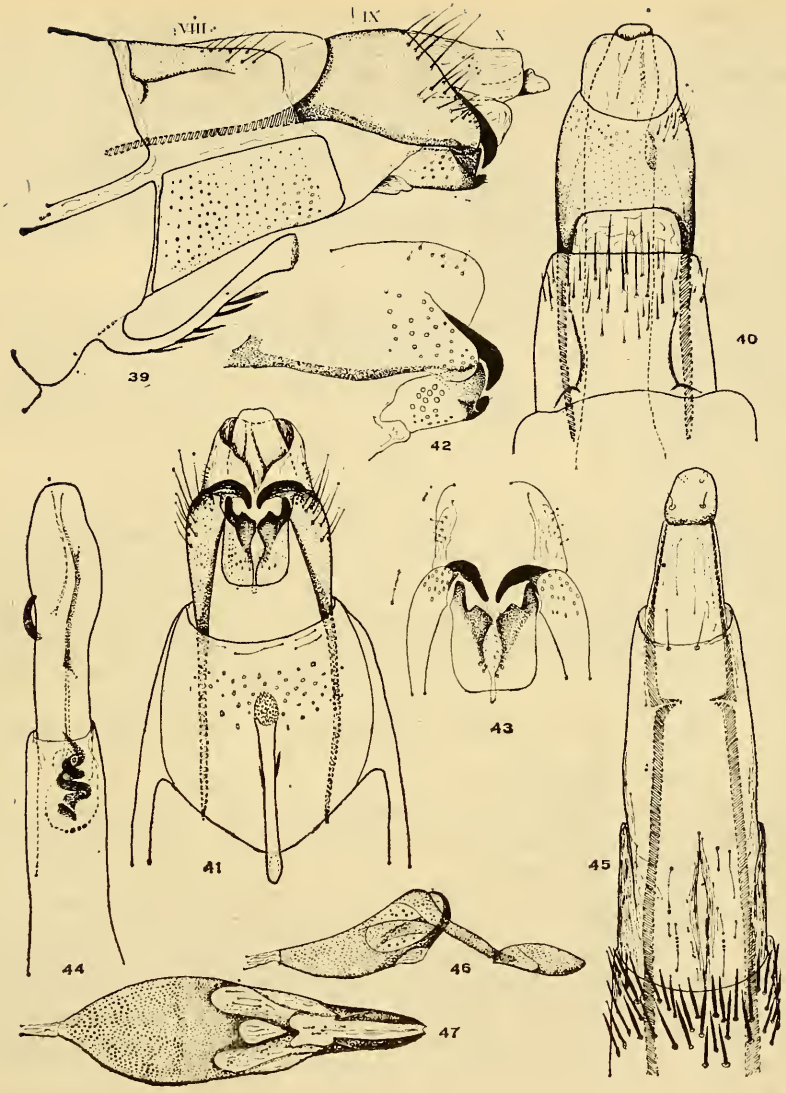
Material studied: Loc. 2 b — holotype male, 4 ♂ and 29 ♀ paratypes.

Derivatio nominis: Sujang-san (=Sujang Mts.).

Discussion: This species clearly belongs to the W and SW Asian group of *martynovi*. Its main distinctive features are in the structure of the aedeagus and the form of inferior appendages. It could be considered (although not very closely) related to *S. tjederi* Schm. from Pakistan, while *S. makartschenkoi* Bots. & Levan., described recently (Botosaneanu, Levanidova, 1988) from the southernmost of the Kurile islands seems to occupy an isolated position within the above-mentioned group.

Although the immature stages and their proper habitat in particular remain unknown, it could be suggested after the type of the collecting site of the adults that *S. sujangsanica* sp. n. is most probably a hygropetric caddisfly (like most *Stactobia*, and in contrast to *S. makartschenkoi*, which is a supposed benthic rhithrobiont).

Hydroptila emarginata Martynov, 1927 (=*H. bajgirana* Botosaneanu, 1983 syn. nov.).



Figs. 39-47. **Genitalia** of *Stactobia sujangsanica* sp. n.
M a l e: 39 — lateral; 40 — dorsal; 41 — ventral; 42 — distoventral portion of genitalia (stronger magnified), lateral; 43 — the same, ventral; 44 — aedeagus, ventral. F e m a l e: 45 — **end** of abdomen, ventral; 46 — Processus spermathecae, lateral; 47 — the same, **ventral**

This species was found in Korea (Phyongyang) in June (B o t o s a n e a n u, 1970). Our material originates from several localities also in the same region: Loc. 17 a — very abundant, collected 38 ♂ and 8 ♀; Loc. 18 a — 2 ♂, 5 ♀; Loc. 23 — 1 ♂.

This species is widespread in the potamal and rhithral of the plain; first described from the Soviet Central Asia, later on it was found to inhabit a vast territory of the Palearctic, from Korea to the Russian Plain. Revising the single male specimen found in Iran by Schmid (S c h m i d, 1959), B o t o s a -

neanu (1983) described it as a new species, i. e. *H. bajgirana* Bots., stressing on its main distinctive features. Having examined a pretty large series of *H. emarginata*, I can now confirm the existence of variability in some of those features of the genitalia males, noted partly by the same author some earlier (Botosaneanu, 1970). In fact, the diagnostic features of *H. bajgirana* are almost entirely covered by the ones of *H. emarginata* and I consider them conspecific, notwithstanding the difference in the segments of the antennae — 30 in the specimen from Iran, and 32 in our Korean material.

Hydroptila phenianica Botosaneanu, 1970

Material studied: Loc. 10 — 5♂, 2♀; Loc. 11 — 1♂; Loc. 18a — 5♂, 11♀; Loc. 23 — 2♂, 1♀ pupa, and 5 empty cases; "North Korea, VIII. 1982" (probably Loc. 18 h) — 1♂, 1♀.

Another potamobiont known only from Korea so far, but possibly occurring also in the adjacent territories.

Hydroptila moselyi Ulmer, 1932

Material studied: Loc. 18 a — 1 ♂; Loc. 29 c — 1 ♂.

This species was described from China ("Peiping") long ago and I could not find any new information published since then. Although the description and the figures in particular do not look sufficiently detailed now, the material from Korea most probably belongs to it. *H. moselyi* is a member of the group of *tineoides*. Besides new genital figures of male (female still practically unknown) (Figs. 48-50), in addition to its diagnosis I would note that the antenna is 30-articled.

Distribution: insufficiently known — NE China, Korea.

Hydroptila botosaneanui sp. n.

In habitus very similar to *H. tineoides* Dalm., differences in some of the genital elements. Length of forewing, 2,6 mm (♂, ♀). Antennae 30-segmented in male, 24-25- in female.

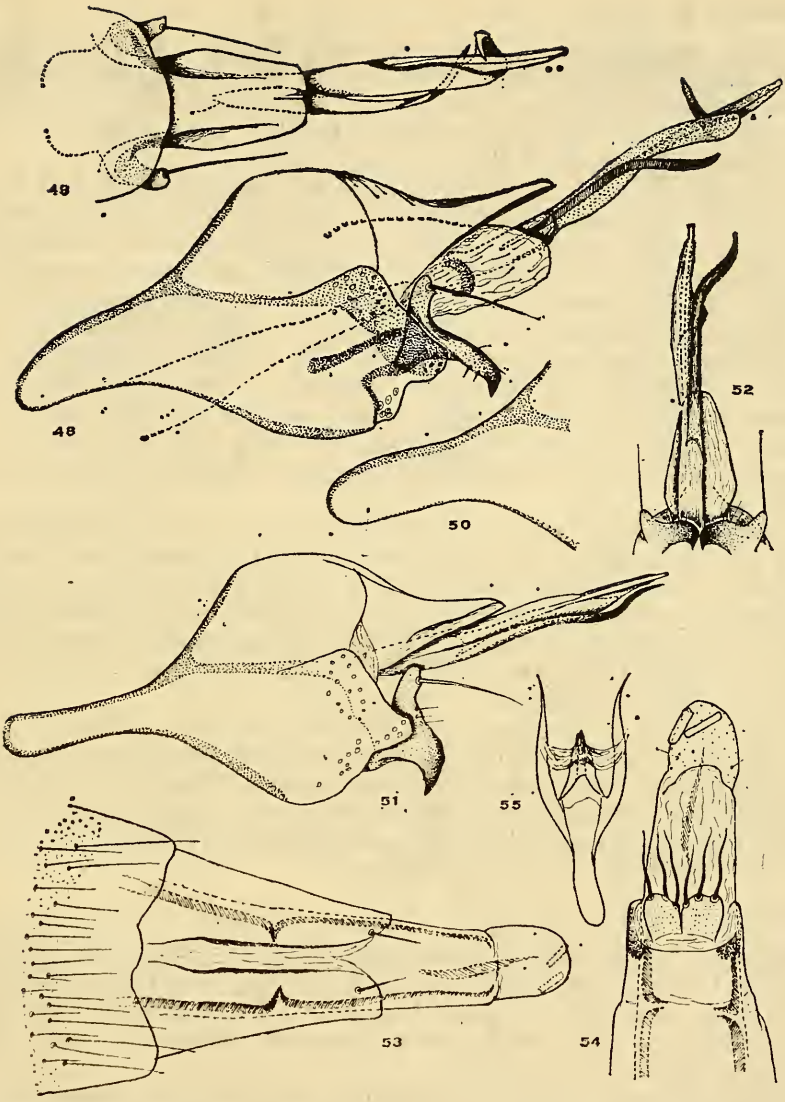
Male genitalia. Anterolateral apodemes of segment IX parallel-sided, elongate (Fig. 51), but somewhat shorter than the segment itself. Dorsal plate of segment X narrow, blunt at tip (Fig. 52). Ventral parts of inferior appendages forming short and somewhat rough hooks. Aedeagus straight, its subapical portion slightly twisted and enlarged. Paramere faintly sinusoidal, projected as far as aedeagus, with its terminal portion slightly bent (Fig. 51), and not as in *H. tineoides*, sharply bent.

Female genitalia. Also rather resembling those of *H. tineoides*. Tergal part of segment VIII divided into two elongate sclerites, each bearing one distodorsal seta. Dorsomedial edges of these sclerites marked with two parallel, dark lines (Fig. 53). Sternal part of segment VIII with two distinct, short, almost contiguous lobes, each with 3 strong setae (Fig. 54). Segment IX entirely membranous, with a darker internal fold. Processus spermathecae with slightly asymmetrical oral portion (Fig. 55).

Material studied: Loc. 9a — holotype male and 2 ♂ paratypes; Loc. 12 — 1 ♂ and 1 ♀ paratypes; Loc. 29b — 1 ♂ and 1 ♀ paratypes.

Derivatio nominis: This species is named in honour of the eminent specialist and my excellent colleague Dr. L. Botosaneanu whose paper on Korean caddisflies (1970) remains the fundamental work in modern rsearch in that area of entomology.

Discussion. This is the second species in Korea of the predominantly Nearctic group of *tineoides*. Its closest species is namely *H. tineoides* Dalm.,



Figs. 48-55. Genitalia of *Hydroptila moselyi* Ulm., and *Hydroptila botosaneanui* sp. n. *H. moselyi*: 48 — genitalia ♂, lateral; 49 — the same (distal part), dorsal; 50 — apodeme of segment IX (of another specimen), lateral. *H. botosaneanui:* 51 — genitalia ♂, lateral; 52 — the same (distal part), ventral; 53 — genitalia ♀, dorsal; 54 — the same, ventral; 55 — Processus spermathecae, ventral

which could be considered the West Palearctic sister form of *H. botosaneanui* sp. n., while *H. mosely* belongs to a different line with some N. American species probably related. The new species is distinguished by: anterolateral apodemes not skittle-shaped and not longer than the rest of segment IX, ventral portion of inferior appendages ("the hooks") rough and shortened, aedeagus enlarged preapically and paramere not sharply bent at tip (male), and distoventral lobes of segment VIII very close (female).

Hydroptila asymmetrica sp. n.

Forewing length, male 2,2-2,5 mm, female 2,6 mm. Male antennae 29-32, female — 25-segmented. General colour (in alcohol) brownish. Eversible scent organs on male head in form of two membranous, long tubes with sparse filaments along the length and a dense apical brush of filaments. Most of genital units apparently asymmetrical.

Male genitalia. Ventromedial process of sternite VII long. Segment IX fused, its oral margin evenly convex laterally, with equal dorso- and ventromedial excisions; right side of this segment better developed (Fig. 58). Distolateral wings of segment IX also unequal, each bearing several strong setae (Figs. 56, 57). Dorsal plate of segment X membranous, dorsally an irregular trapezium. Medially of the distolateral wings of segment IX a pair of big, rounded lobes (gonopods?), each with a small, membranous, finger-like processus bearing a terminal seta. Medially of these lobes and in lateral view almost hidden by them, a pair of dark, heavily chitinized hooks directed downwards. Aedeagus a simple, tapering, very long tube; its oral end usually at segments VI-VII level; its distal portion characteristically curved to the right (Figs. 58, 59).

Female genitalia. Sternite VI with a short ventromedial point. Segment VIII with two single distodorsal setae, two groups with three strong setae along its distoventral border, and a strongly asymmetric internal complex of groove- and sack-shaped structures situated in the ventral part of the segment, on Fig. 61 only sketched. Processus spermathecae symmetrical (Fig. 63).

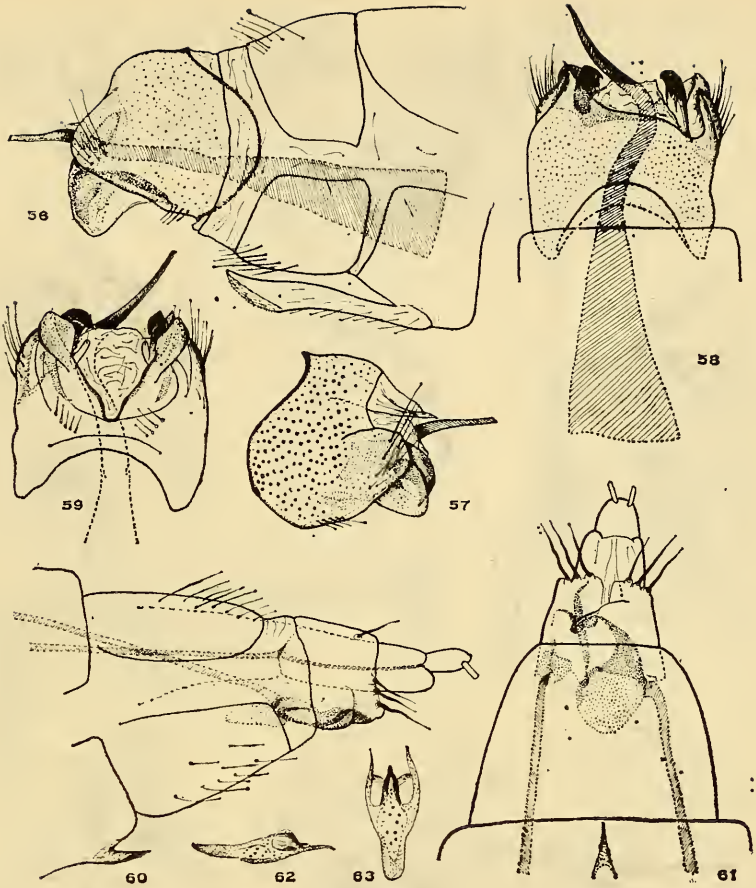
Material studied: Loc. 9a — 11♂ paratypes; Loc. 10 — holotype male, 4♂ and 2♀ paratypes.

Discussion. Although with all the principal features of the genus are present (ocelli lacking, spurs 0,2,4, scent organs developed etc.), this new species cannot be referred to any of the known groups of species known. The asymmetry of genitalia in both sexes determines a very isolated systematical position for *H. asymmetrica* sp. n. The only species seemingly related to it is the other asymmetrical *Hydroptila* described below.

Hydroptila extrema sp. n.

Somewhat bigger than *H. asymmetrica* sp. n., otherwise resembling it very much. Length of forewing, male 2,8-3,2 mm., female 2,8 mm. Antenna segments 36 in male, 27 in female. Eversible scent organs on male head very long, membranous tubes, with sparce filaments subapically, and dense ones at tip (Fig. 64).

Male genitalia. Sternite VII with long ventromedian process. Segment IX fused, its ventral part very narrow; anterolateral margins evenly rounded, apodemes lacking. Distolateral ventral corners of segment IX modified into two long, relatively slender, asymmetrical processes pointing dorsocaudad, left one apparently shorter (Fig. 66). Dorsal plate of segment X short, membranous. A pair of well chitinized processes ("intermediate appendages"?) surrounding the aedeagus laterally; each of them consists of a big, downwards curved hook, and a smaller but distinct dorsal hook (Fig. 65). Viewed dorsally, these hooks appear as strongly capitate, angulate processes (Fig. 67). Ventral side of segment X with a transversal chitinous plate, passing laterally into two very strong, concave appendages ("inferior appendages"?). Aedeagus strongly asymmetrical, well chitinised, distinctively curved and with its caudal portion pointing right (Figs. 66, 67). Paramere, as in *H. asymmetrica* sp. n., absent.

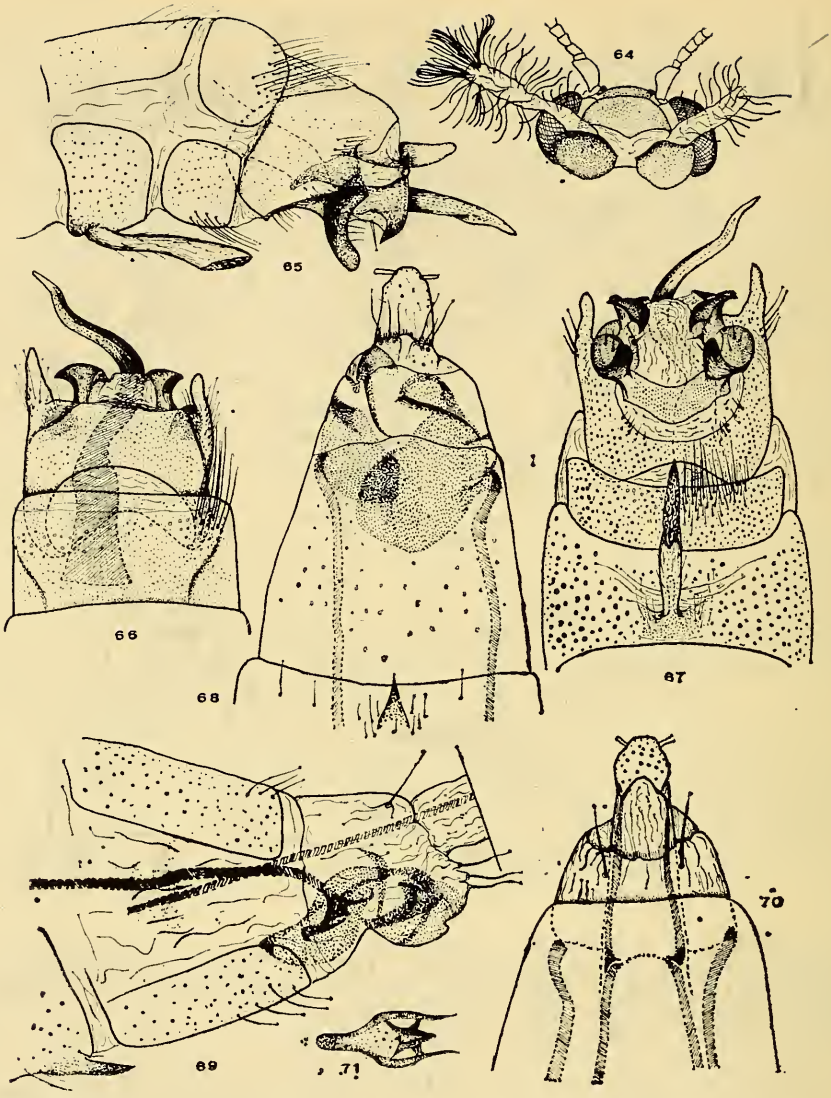


Figs. 56-63. Genitalia of *Hydroptila asymmetrica* sp. n.
M a l e: 56 — lateral view of the right; 57 — the same, left; 58 — dorsal; 59 — ventral.
F e m a l e: 60 — end of abdomen, lateral; 61 — the same, ventral; 62 — Processus spermathecae, lateral; 63 — the same, ventral

F e m a l e g e n i t a l i a. Also resembling those of *H. asymmetrica* sp. n. but segment VIII here with even greater asymmetry (Figs. 69-70).

M a t e r i a l s t u d i e d: Loc. 18a — paratype male; Loc. 29 a—holotype male; Loc. 29b — paratype female.

D i s c u s s i o n. The above described *H. asymmetrica* sp. n. seems to be the only species related to this peculiar new species; *H. extrema* sp. n. could easily be recognized by its large size and by several featues of male genitalia (e. g. aedeagus shorter but strongly curved, the form of both intermediate and inferior appendages, etc.), as well as by the highly asymmetrical female genitalia (the association of the sexes is not absolutely sure and is based on the peculiar asymmetry in their genitalia and on the common habitats). These two species form a very distinct group within the genus — that of *asymmetrica*. Recently, Prof. Tiang Li-Xin has kindly informed me about a species collected in June, 1985 on Tianmu Mts. (Prov. Zhejiang, E. China). Comparing the male genital figures it is evident that this species is closely related (if not even



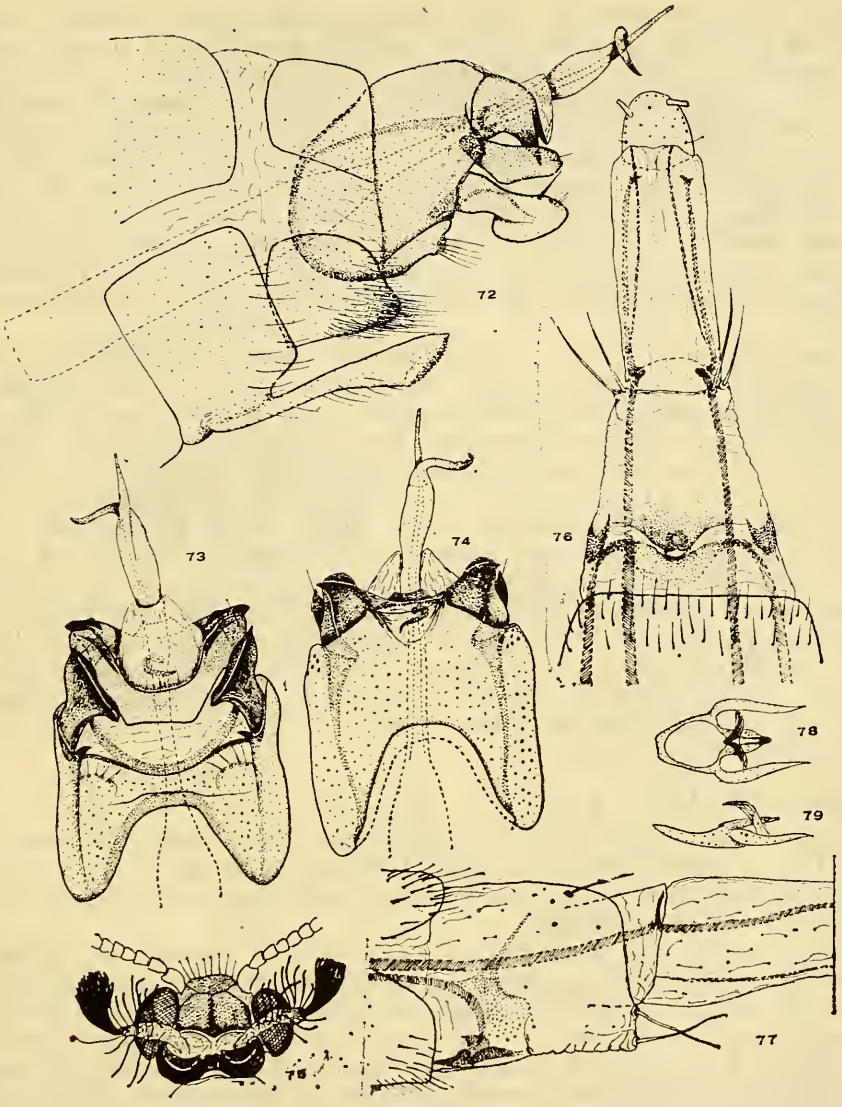
Figs. 64-71. Head of male and genitalia of *Hydroptila extrema* sp. n.
Male: 64 — head with eversed scent organs (partly), dorsobasal; 65 — genitalia, lateral; 66 — the same, dorsal; 67 — the same, ventral. Female: 68 — end of abdomen, ventral; 69 — the same (partly), lateral; 70 — the same, dorsal; 71 — Processus spermathecae, ventral

the same) to *H. extrema* sp. n.[1] The only apparent difference between them seems to be the position and the form of the aedeagus, in the insects from China even more curved and its caudal portion pointing to the left.

Hydroptila coreana sp. n.

Small insects. Forewing length, male 1,9-2,3 mm, female 2,3-2,4 mm. Number of antennal segments various, 27-30 in male, 23-25 in female. Head with the usual, paired eversible scent organs (Fig. 75). General colour (in alcohol) brownish.

[1]The supposed identity has just been confirmed (in litt.) by Assoc. Prof. Yang Lian-fang (from Prof. Tian's lab).



Figs. 72-79. Head of male and genitalia of *Hydroptila coreana* sp. n.
M a l e: 72 — genitalia, lateral; 73 — the same, ventral; 74 — the same, dorsal; 75 — head with eversed scent organs, dorsobasal. F e m a l e: 76 — end of abdomen, ventral; 77 — the same (partly), lateral; 78 — Processus spermathecae, dorsal; 79 — the same, lateral

M a l e g e n i t a l i a. All details except the paramere and the subapical process of aedeagus, symmetrical. Median process of sternite VII long, slightly expanded at tip. Sternite VIII densely pubescent. Proximal margin of segment IX evenly rounded in side view (Fig. 72), its dorso- and ventromedian excisions similar. Ventral portion of segment IX a narrow strip and with two small laterobasal bulbs, each bearing 4-5 long setae. Hind margin of segment IX almost straight; ventrocaudal corners modified into small dark spines pointing mediad and visible only from beneath (Fig. 73). Dorsal plate of segment X

a minute, chitinous trapezium. Three pairs of appendages projected equally caudad appear behind segment IX: the superior ones present strong, doubled beaks pointing downwards and surrounding sidely the aedeagus; the intermediate pair is elongate, well sclerotised and arises from a common basal plate which surrounds ventrally the aedeagus; the ventral pair (inferior appendages) presents two widely separated and heavily modified processes with their distal portion obtuse and, viewed laterally, elongate-capitated (Fig. 72). Basal part of aedeagus a very long, bottle-shaped tube, distal part much shorter. The latter consists of a needle-like terminal tube and a preapical dilatation which ends in one sinuscidal, directed left, process (Figs. 73, 74). Paramere a short spiral directed orally and situated in the base of the distal section of aedeagus.

Female genitalia. Ventromedian process of sternite VI small, acute. Segment VIII almost entirely membranous, with one premarginal seta in each dorsal corner and two distolateral pairs of ventral setae (Fig. 77); its ventral side with undulate transverse groove separating two inner chitinous plates (Fig. 76). Processus spermathecae with broadened oral portion (Fig.78).

Material studied: Loc. 9a— 1 ♂ and 1 ♀ paratypes; Loc. 29 a— holotype male, 12♂ and 9♀ paratypes; Loc. 29b — 7♂ and 4♀ paratypes.

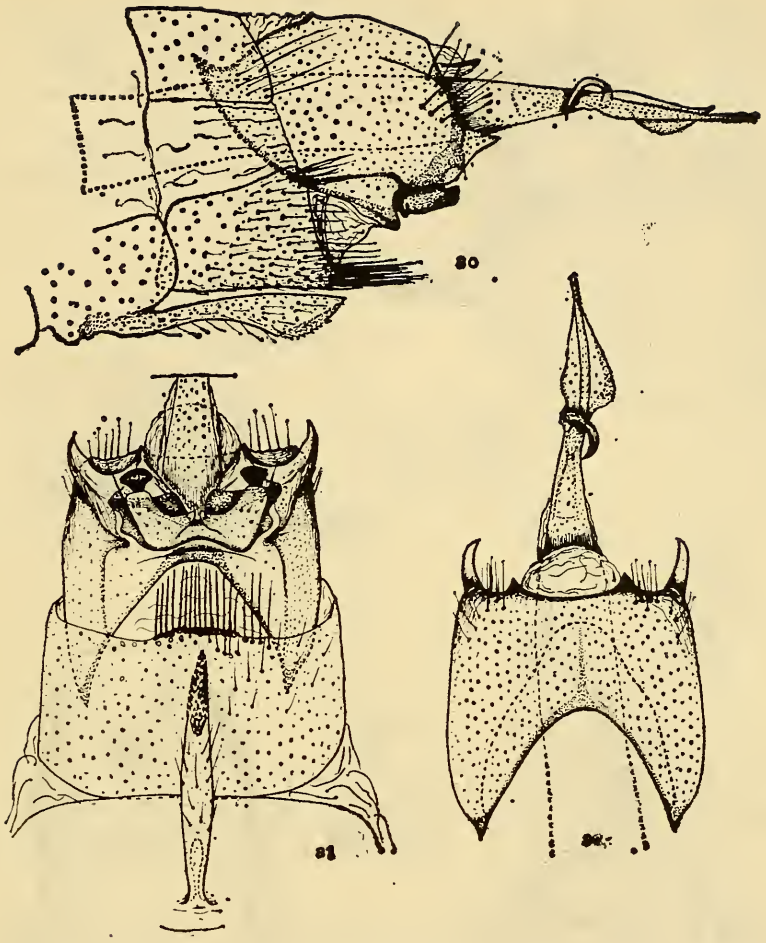
Discussion. Seemingly there is no other species related to *H. coreana* sp. n. The latter is easily recognizable by the form of segment IX and the appendages and aedeagus in male genitalia, and also by the ventrobasal structure and the chaetotaxy of segment VIII in female. Similar type of dislocation and number of setae has been found in the female of the species described below. The other genital features, however, are quite different in the two species and they can be neither grouped, nor attached to any of the groups already established in Korea.

Hydroptila hubenovi sp. n.

Length of forewing, male 2,6 mm, female 2,5-2,8 mm. Antennal segments 31-32 in male, 25 in female. Scent organs, male, of the common type — long, eversible tubes with dense terminal brush of sensory filaments. General colour (in alcohol) brownish.

Male genitalia. Entirely symmetrical except the aedeagus. Sternite VII with long and somewhat expanded caudally, pointed process. Segment IX fused; its anterior margin with deep dorsomedial excision and still deeper ventromedial one, i. e. the ventral part of that segment very narrow. Segment IX, viewed laterally, specifically shaped: its anterior margin with acute, up-turned lateral corners; distobasal corners also acute, in form of slightly curved medially, triangles (Fig. 80). Dorsal plate of segment X a short, rounded membrane with a dark corner on either side. These corners (intermediate appendages?), in fact, surround laterally the aedeagus and, although short, are considerably modified — in ventral view capitate (Fig. 81), laterally with short, beak-like processes (Fig. 80). Inferior appendages concave (Fig. 81), laterally protruding as a dark plate below the distobasal corners of segment IX. Aedeagus distinctly divided into a very long, tubular proximal portion, and a short, distal one. The latter consists of slender tube and semimembranous, asymmetrical lobe. Paramere a short, directed orally spiral, attached close to the "neck" between the two parts (Figs. 80, 82).

Female genitalia. Sternite VI with acute median process. Abdominal sclerites densely pubescent. Segment VIII semimembranous, with three setae on each side: one dorsal premarginal, and two ventromarginal ones (Fig. 83). Viewed ventrally, this segment with one V-shaped inner plate and



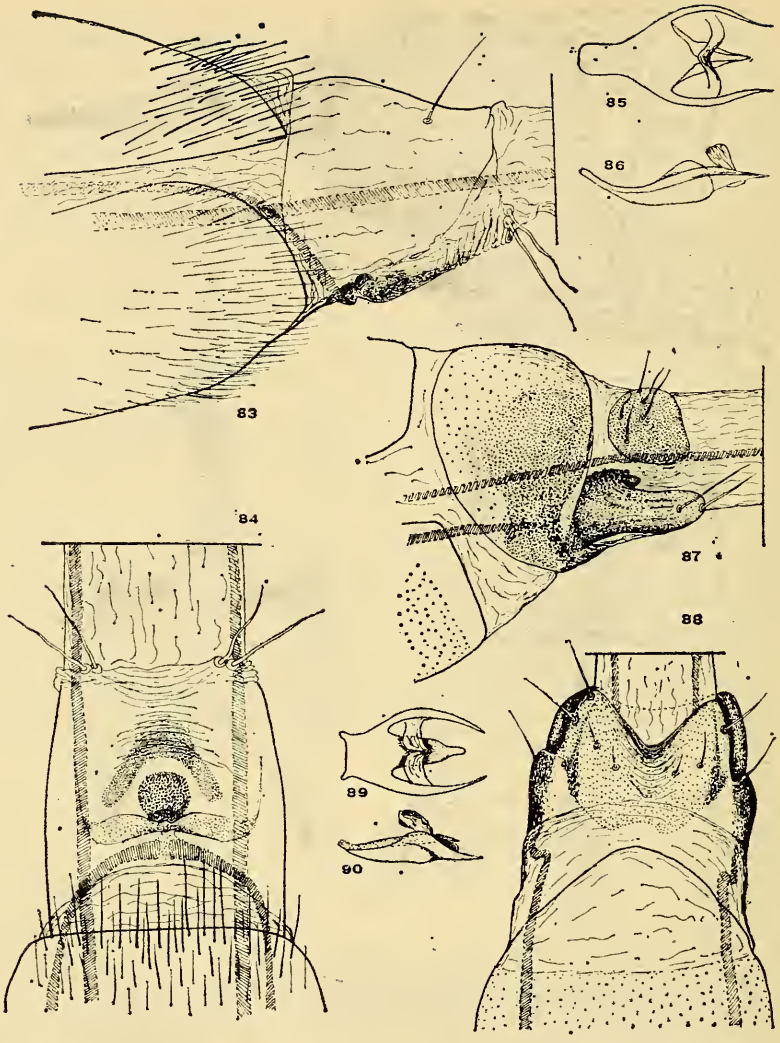
Figs. 80-82. Male genitalia of *Hydroptila hubenovi* sp. n.
80 — lateral; 81 — ventral; 82 — dorsal

a granular rounded body embraced by it (Fig. 84). Segments IX and X long, retractile. Oral part of processus spermathecae a typical "manubrium" (Fig. 85).

Material studied: Loc. 9a — holotype male, 12 ♂ and 5 ♀ paratypes; Loc. 10 — 1 ♂ and 1 ♀ paratypes.

Derivatio nominis. I name this new species after my colleague Dr. Zdravko Hubenov (Institute of Zoology, Sofia) who has collected a great deal of the caddisflies in 1987 in Korea.

Discussion. As in the previous species, *H. hubenovi* sp. n. cannot be placed in any of the groups of *Hydroptila* recorded in Korea (i. e. those of *sparsa*, of *tineoides*, and of the above formed group of *asymmetrica*) so far. This species could be recognised by its short genital appendages, acute frontolateral corners of segment IX, and the particularities of the aedeagus in the male and of segment VIII in the female. Besides Korea, it has just been established also in E. China (Assoc. Prof. Yang Lian-fang, in litt.)



Figs. 83-90. Female genitalia of *Hydroptila hubenovi* sp. n., and *Hydroptila* sp. *Hydroptila hubenovi:* 83 — genitalia, lateral; 84 — the same, ventral; 85 — Processus spermathecae, ventral; 86 — the same, lateral. *Hydroptila* sp.: 87 — genitalia, lateral; 88 — the same, ventral; 89 — Processus spermathecae, dorsal; 90 — the same, lateral

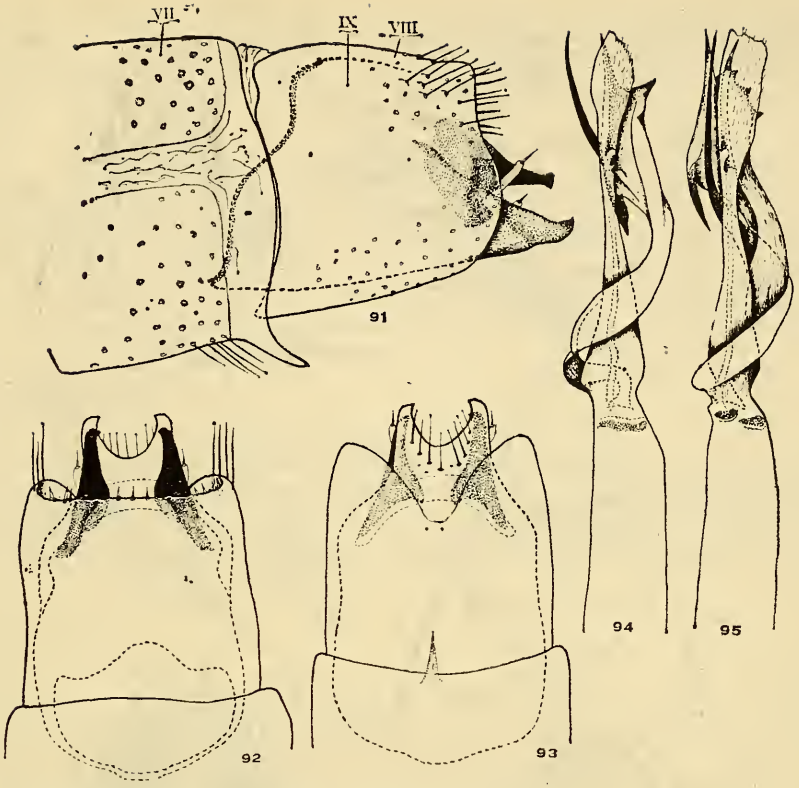
Hydroptila sp.

Material studied: Loc. 23 — 1 ♀.

This single female does not belong to any of the above-listed species. It could possibly belong to a new species, but until not associated with male, I prefer to leave it unnamed, giving a preliminary description.

A rather large *Hydroptila*; forewing length, 3,5 mm. Antenna with 25 segments. Colour brownish.

Female genitalia. Sternite VI with a small and acute median process. Segment VII long, segment VIII shortened, with its lateral sides better sclerotized than the dorsal one. Tergal part of segment IX with two scle-



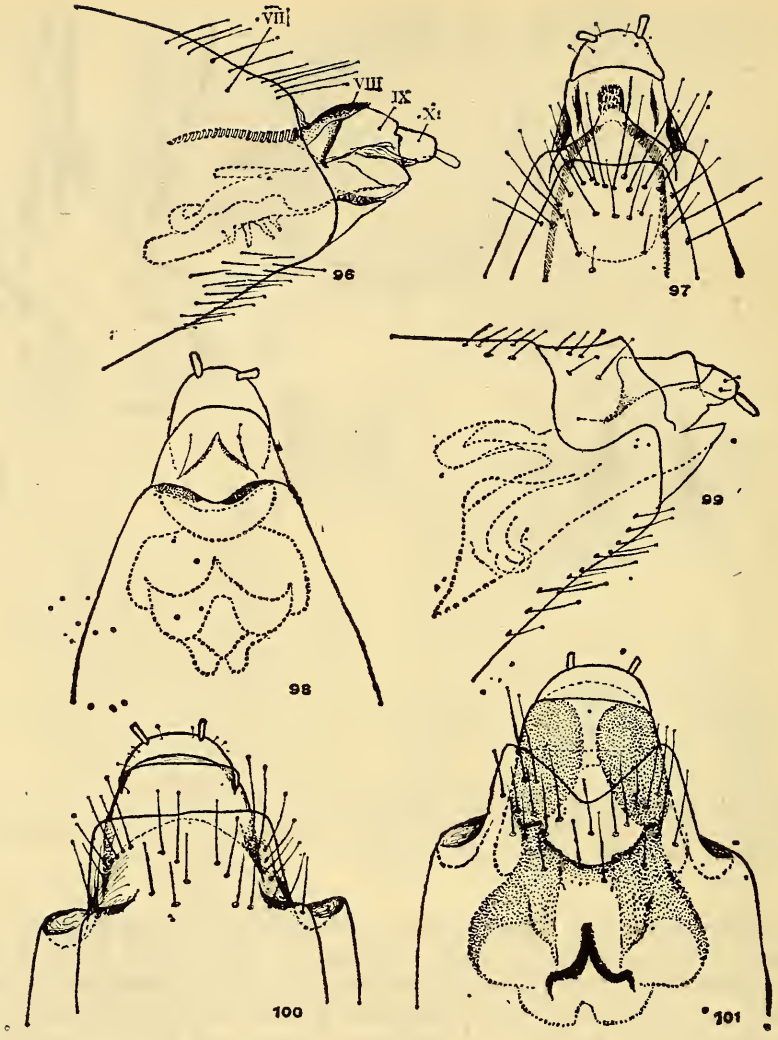
Figs. 91-95. Male genitalia of *Oxyethira josifovi* sp. n.
91 — lateral (aedeagus omitted); 92 — the same, dorsal; 93 — the same, ventral; 94 — aedeagus, lateral; 95 — the same, dorsal

rotized, broadly separated lateral zones, each bearing 5 setae (Fig. 87). A distinct chitinous unit (ventral plate?) attached to the ventral part of segment IX; viewed ventrally, this plate divided deeply by a V-shaped excision, each of its branches with several setae (Fig. 88). Processus spermathecae with distinctively shaped oral portion — shortened, broad and with accented corners (Fig. 89).

Oxyethira josifovi sp. n.

Forewing (♂, ♀) 2,5 mm. Antenna with 39 segments in male and 25 in female. Colour seemingly light, in alcohol pale brownish.

Male genitalia. Sternite VII with acute distomedian process. Segment VIII nearly as long as high; its dorsocaudal margin straight, with a row of sparse, short and spinelike setae; ventrocaudal margin deeply excised in the middle (Fig. 93). Segment IX withdrawn into VIII, its lower half much longer than upper, anteroventrally extending into segment VII (Fig. 91). Claspers arising from a common, trapezial ventrodistal plate ("gonopodial plate"), separated by a semicircular median excision (Fig. 93). Dorsad of claspers and somewhat less projected, a pair of heavily sclerotised, separate blunt sticks, connected with the distolateral corners of segment IX and, probably, presenting the subgenital plate. A feebly visible pair of hyalin processes ("bilobed



Figs. 96-101. Female genitalia of *Oxyethira josifovi* sp. n., and *Oxyethira* sp. *Oxyethira josifovi:* 96 — end of abdomen, lateral; 97 — the same, dorsal; 98 — the same, ventral. *Oxyethira* sp.: 99 — end of abdomen, lateral; 100 — the same, dorsal; 101 — the same, ventral

processes''), each with a terminal seta, enclosed laterally to the stick-like appendages. Aedeagus distally membranous. Paramere a spiral band which distal portion extremely complicated in structure; this portion includes a very long spine and a lobe armed with several various spines and dents, some of them directed proximad (Figs. 94, 95).

F e m a l e g e n i t a l i a. Segment VII with long hairs, ventrally slightly produced; its distoventral margin shallowly excised (Fig. 98). Tergite VIII with long proximal apodemes and very narrow, finely spinulated, distal portion (Fig. 97). Vaginal sclerites strongly complicate in shape, on Fig. 98 sketched only.

Material studied: Loc. 10 — holotype male, and 6 ♀ paratypes.

Derivatio nominis: I devote this species to the eminent Bulgarian hemipterologist Dr. Michail Josifov (Institute of Zoology, Sofia), whose collecting activity in Korea enabled also several interesting trichopterological results.

Discussion: *O. josifovi* sp. n. is the second *Oxyethira* in Korea. Like the probable Korean endemic *O. campanula* Bots., it also belongs to the group of *flavicornis*, but is related to the widespread *O. ecornuta* Mort. (Ontario, Fennoscandia, the Soviet Far East), rather to *O. campanula*. The new species could easily be distinguished after the differences in the shape of the subgenital plate, of the gonopodes, and of the paramere in the male. As concerned the females, they remain unknown for the two other *Oxyethira* discussed here.

Oxyethira sp.

Material studied: Loc. 9a — 2 ♀.

These insects (length of forewing 2,5 mm., antenna 25-segmented) are looking entirely different from the female of *O. jossifovi* sp. n., but unless associated with male, their further determination would be incorrect. Nevertheless, the genital features of these female are shown here on Figs. 99-101.

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ИССЛЕДОВАНИЯ ФАУНЫ РУЧЕЙНИКОВ (TRICHOPTERA, INSECTA) КОРЕИ. I. НАДСЕМЕЙСТВО RHYACOPHILOIDEA

Красимир Кумански

(Р е з ю м е)

Настоящая работа включает первые результаты начатой автором обработки нескольких коллекций ручейников КНДР, собранных в период 1970—1987 гг. Из этого надсемейства в общем установлено 7 родов и 28 видов, которые распределяются по семействам, как следует: Rhyacophilidea — 1 род, 11 видов; Hydrobiosidae — 1 род и вид; Glossosomatidae — 2 родов, 4 видов; Hydroptilidae — 3 родов, 12 видов. Новыми для науки являются 8 видов: *Rhyacophila kumgangsanica* sp. n., *Stactobia sujangsanica* sp. n., *Hydroptila botosaneanui* sp. n., *H. asymmetrica* sp. n., *H. extrema* sp. n., *H. coreana* sp. n., *H. hubenovi* sp. n. и *Oxyethira josifovi* sp. n. Для энтомофауны Кореи новыми являются еще *Synagapetus jacutorum* M a r t. и *Hydroptila moselyi* U l m. и, с большей или меньшей вероятностью, неокончательно определенные самки *Rhyacophila* sp., *Hydroptila* sp и *Oxyethira* sp. Кроме новых таксонов, иллюстрированы еще неизвестные или неполным образом описанные мужские гениталии 2 видов и женские гениталии 9 видов.